ARM SUPPORTS

The present invention relates to apparatus for and a method of supporting a part of the body of a person whilst that person undertakes a task, for example, a task requiring precise and/or accurate work.

It is well known that back pain is a major cause of disability and absenteeism in industrialised countries. Ergonomic studies have also shown that workers with awkward static working postures, such as dentists, dental hygienists, antenatal ultrasonographers and surgeons, are at high risk of developing musculoskeletal pain and injuries in the shoulders, neck and upper and lower parts of their torso.

The above-mentioned health workers and, in particular, dental health professionals work with a slightly flexed torso and abducted arms. This awkward, abnormal posture, which needs to be maintained while treating patients or undertaking the clinical procedure, places excessive loads on the musculoskeletal structures of the shoulders and the torso.

Further, office workers, in particular secretaries or computer operators, whose work includes operating keyboards are also at risk of shoulder and back pain due to the abducted arm posture which needs to be maintained over extended periods of time. There is also the risk of repetitive strain injury caused by supporting the weight of the arms on the wrists whilst operating a keyboard.

The apparatus of the current invention is intended to alleviate or prevent musculoskeletal problems associated with working in awkward positions, for example with abducted arms with a substantially static posture.

Previous efforts to prevent or reduce excessive loading and the associated musculoskeletal problems of the shoulders and the torso of health workers have not been conclusively successful. The main reason for this lack of success is often the restriction that the solutions present to the worker or operator (for example the dentist) in carrying out their work. For example, some chairs for dentists provide some level of load relief only when the dentist is not treating the patient or accessing the mouth.

DE 4109389 discloses a chair for use in a dental practice which has a pair of back/arm supports, one being mounted vertically above the other. The back/arm supports are vertically adjustable. The supports have very limited movement (in a horizontal sense) with respect to the seat.

DE 4306918 discloses a chair which has a pair of rests to support the forearms of an individual performing high precision work. The rests are located on a common mounting and are not individually adjustable with respect to the vertical or horizontal axes, nor are the rests adjustable to adopt different inclinations.

Other solutions have been proposed in which a support is provided for the forearm which swivels and is pivotable. However, there have been found to be unsuitable because they require the dentist to exert some effort to keep the arm and elbow stationary whilst working on the mouth. Moreover, if the supports are freely

swivellable the support can move when the dentist's arm is not in contact with the support. Thus, when the dentist is required to move the arm or adjust the position of his arm in order to move the tools within the mouth, it can prove difficult for the dentist to return the arm back on the armrest without looking at it or using the other arm to reposition the swivelling part. Furthermore, attempts to load the armrest, as is intended, whilst applying a tool in the patient's mouth may cause movements of the armrest thereby destabilising the dentist's arm, with potentially disastrous consequences.

To prevent injury to operators of keyboards, pads positioned on the edge of the desk may be provided to support the wrists of the operator. This arrangement applies pressures to the wrists which can increase the pressure within the carpal tunnel resulting in undue pressures on the nerves. More importantly, to operate a keyboard with excessively extended fingers places the finger joints in a biomechanically disadvantageous posture which can lead to tiring in the short terms and repetitive strain injury in the long term.

It is an object of this invention to provide apparatus which overcomes one or more problems associated with the prior art.

It is a particular non exclusive object of the invention to provide apparatus which can alleviate the load experienced by the shoulders and torso of a user when working in a static position.

It is a further, non-exclusive, object of the invention to provide apparatus which is usable by a variety of workers, which is non-restrictive to the task to be

undertaken, ergonomic and can provide a safe, stable support surface regardless of the position or angle of approach to the area in which the task is to be performed.

Accordingly, a first aspect of the invention provides seating means having a seat and a support surface mounted on a frame member for supporting the arm of a user, the support surface being vertically positionable at first user-defined positions above the seat and being pivotally mounted on the frame member to allow the support surface to be positionable in a plurality of second user-defined positions to support the forearm thereof whilst undertaking a task, say, in front of the user.

A second aspect of the invention provides a device to support the arm of an operator, the device comprising an arm support pivotally attached to a frame member, the frame member being mountable or attachable to seating means; and means to allow the support surface to be positionable at user-defined positions above the chair when attached thereto and being positionable in a plurality of user-defined positions for supporting a forearm thereof whilst undertaking a task, say, in front of the user.

A plurality (*e.g.* a pair) of support surfaces may be provided, each preferably being mounted on a dedicated frame member. Each support surface may be vertically positionable with respect to the seat and/or each support surface may be pivotally positionable in a plurality of user-defined positions.

In an embodiment, the or each support surface is curved. The or each support surface may be of semi-circular, elliptical or otherwise curved form.

The or each support surface may be mounted to a respective frame member thereof by a universal joint, which is preferably lockable to secure the support surface in a particular user-defined position, the universal joint allowing the support surface to be freely rotatable about the frame member.

Preferably, the or each frame member is elongate, the support surface preferably being mounted at one end of its associated member.

The frame member may be telescopic, for example comprising a first tube telescopically located within the bore of a second tube, the first being relatively axially translatable with respect to the first by operation of resilient means, for example, a pneumatic gas lift, spring or so on.

The support surface preferably provides a forearm support surface which can be locatable outside of the footprint of the seat when in use, *i.e.* when viewed from above, the support surface is locatable outside of the perimeter defined by the seat.

A consideration is the safety of the operator and the stability of any chair which incorporates the support. Since, in some embodiments, the support is attachable to either or both sides of a chair and is usable when protruding outward and forward from the seat, the loading of the support should not disturb the balance of the chair. Accordingly, the support may be rotatable and/or translatable into a usable position when the operator is seated on the chair and is preferably rotatable and/or translatable into a 'mechanically safe' position before the operator can rise from or move out of the chair. This may be achieved by ensuring that during use part of the support locates directly in front of the operator, thereby making it physically

impossible for the operator to rise from or move out of the chair without rotating and/or translating the support into a mechanically safe position.

A third aspect of the invention provides a dentists chair in which a patient is seatable, the chair comprising a support surface for the arm of an operator mounted on a frame member, the support surface being vertically positionable at first user-defined positions vertically displaced above the seat and being pivotally mounted on the frame member to allow the support surface to be positionable, when in use, in a plurality of second user-defined positions in front of the user to support a forearm thereof whilst undertaking examination or treatment of the patient seated in the chair.

A fourth aspect of the invention provides an arm support for a chair in which a patient is locatable for examination or treatment, the support comprising a pivotable member having a substantially horizontal support which, in use, is usable to support a forearm of a clinician examining or treating the patient.

A further aspect of the invention provides a method of performing a task with hands, the method comprising a person supporting one of their forearms on an arm support as previously described to reduce the load in their shoulders and/or upper torso and/or the force acting upon the wrist; and performing the task with the hand attached to the respective forearm.

In this application, the terms seat, stool, chair, seating means are intended to be exchangeable and equivalent.

In order that the invention may be more fully understood, it will now be described, by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of a chair according to the invention;

Figure 2 shows a detail of a first embodiment of support according to the invention;

Figure 3 shows a detail of the second embodiment of support according to the invention;

Figure 4 shows a perspective view of a detail of a third embodiment of support according to the invention,

Figure 5 shows a side elevation of the support of Figure 4;

Figure 6 shows a chair incorporating a fourth embodiment of support according to the invention;

Figure 7 shows a chair incorporating a fifth embodiment of support according to the invention;

Figure 8a shows the chair of Figure 7 with the support being moved toward a stowed position; and

Figure 8b shows a detail of Figure 8a.

Referring to Figure 1, there is shown a chair 1 having a seat 2 mounted upon a set of casters 3.

Attached to the chair 1 is a pole 4 at a distal end thereof is located a bracket 5 upon which is mounted a forearm support 10 of semi-circular form, in plan, having two ends 11, 12.

The pole 4 is mounted to the chair 1 to allow for vertical positioning of the support 10 in the direction of arrow A, for example by extending through a bracket (not shown) having a locking nut which can be tightened when the support 10 is at the desired height. The pole 4 has a crank 6 at a point intermediate its ends.

The bracket 5 is a ball and socket joint, the ball having a spigot (not shown) which engages or is attached to the underside of the support 10. Thus the support 10 is rotatable in the direction of arrow B to cause one end 11 of the support 10 to be positioned further from the seat 2 than the other end 12 of the support 10, and *vice versa*. Also, the support 10 is tiltable in the direction of arrow C, thereby causing one end 11 of the support 10 to be above the other end 12 of the support, and *vice versa*. The spigot may be received in a slot (not shown) on the underside of the support 10 and be retained therein by a nut (not shown). Thus, the support 10 may be horizontally slidable with respect to the pole 4, in the direction of arrow D. The support 10 may be secured by using a suitable locking mechanism (not shown).

The bracket 5 has a locking nut (not shown) which can be tightened to ensure that, once positioned, the support 10 is secured in the desired position.

Thus, in use, an operator sits on the seat 2 of the chair 1 and locks the support 10 at the desired height. The support 10 can then be manipulated until the ends 11, 12 of the support 10 are at the desired relative distance from the seated operator and at the desired relative height by locking the nut associated with the bracket 5.

The operator can then support his or her forearms on the ends 11, 12 of the support 10 whilst completing a task.

A non-exhaustive list of tasks which may be eased using the support is dental examination (where typically, one end 11 of the support 10 will be higher than the other end 12 – which one depending on the handedness of the dentist, the dentist may sit with his legs either side of the pole 4 or both legs to one side), surgical examination, operation of a keyboard of a computer or typewriter (where both ends 11, 12 will typically be at the same height and the legs of the operator will typically be located either side of the pole 4). By supporting the forearm of the operator, the load applied to the shoulders is drastically reduced whilst movement of the hands and wrists is not restricted.

The crank 6 of the pole 4 ensures that a portion of the support is located within the footprint of the seat 2 whilst the ends 11, 12 of the support 12 may be both located outside the footprint of the seat 2. This ensures that the load applied to the support 10 does not make the chair 1 unstable.

Referring to Figure 2, there is shown a support 10' on the underside of which is located a spigot 20 which is locatable in a recess 21 of a bracket 5', which is mounted at one end of a pole 4. The pole 4 may be mounted on a chair 1 for vertical positioning, in accordance with the above-description. In this embodiment, the support can be pivoted about the axis of the pole in the direction of arrow B'.

The support 10' may be capable of slidable movement with respect to the pole 4, in accordance with the above description.

Figure 3 shows a dual support 10" and 10a", mounted on a pole 4 using a bracket 5". Extending from each support 10", 10a" is a cranked spigot 20", 20a", the distal end of which is located in an aperture in the bracket 5".

Referring to the right hand support 10" (as shown), the support 10" is mounted on the spigot 20" to allow rotation thereof about the axis of the spigot y_1 as indicated by the arrow E. The spigot 20" is mounted in the bracket 5" to allow rotation of the spigot 2'0' about the axis y_2 of the pol4 4, as indicated by arrow F. The spigot 20" may also be vertically positioned by sliding its end into and out of the aperture of the bracket 5", as indicated by the arrow G. All of the adjustable parts may be locked in place using suitable locking nuts (not shown). It will be appreciated that the support 10a" may be similarly positioned.

In use, the operator positions each support 10", 10a" in the desired position and locks them into place. The supports 10", 10a" are then usable to support eh forearm of the operator whilst the operator sits on a chair. It will be appreciated that the provision of dual supports 10", 10a" enables the operator's forearms to be supported on horizontal supports (in contrast to the tilted support of Figure 1).

Referring now to Figures 4 and 5, there is shown a support 100 to be attached to a dentists chair (not shown) which has a first support 10' (as per Figure 2), rigidly attached to an elongate spigot 20a, and a second support 35.

The spigot 20a extends through an aperture in an elongate frame member 40 (which, in use, would be covered with a head rest (not shown)) and is mounted for rotation in the direction of arrow B'' about its axis y_3.

The second support 35 is a cross-piece of an L-shaped frame 30 formed from two L-shaped members 31, 32. As well as the support 35, the L-shaped members are connected by two further cross pieces 33 and 34. The first 33 joining the ends of the longer legs, the second 34 joining the mid-points of the longer legs and the support 35 joining the ends of the shorter legs.

The cross piece 34 of the L-shaped frame 30 extends through a slide 36, a portion of which being captive in a slot formed in the underside of frame member 40. Thus, the frame 30 is attached to the elongate frame member 40 for relative sliding motion therealong, in the direction of arrow H. The cross-piece 34 also provides a pivot point for the L-shaped frame 30, the frame 30 being rotatable about the axis y_4 in the direction of arrow I.

A screw 37 extends through the cross piece 33 to abut the frame member 40. Screwing the screw 37 towards the frame member 40 causes the cross piece 33 to move away from the frame member 40, in the direction of arrow J. Due to the pivotable connection of the L-shaped frame 30, this causes a corresponding rise away from the frame member 40 in the direction of arrow K of the support 35.

It will be appreciated that both supports 10', 35 are vertically positionable with respect to the seat (the first support 10' via movement of the spigot 20a, and the

second support 35 via movement of the slide 36) and that both supports 10', 35 are pivotally positionable with respect to the seat.

The support 100 may be attached to a dentists chair by removing the 'usual' headrest and inserting member 40 into the headrest mounting, securing it in the mounting in the same fashion as the headrest is secureable. The angle of inclination of the axis of the frame member 40 is usually then between vertical and horizontal. Thus, horizontal planes defined by the supports 10', 35 are movable vertically, as stated above. In a further embodiment, the support 100 may be mounted to the chair using the spigot 20a, the frame member 40 being covered by a headrest.

To use the support 100, the L-shaped frame 30 is rotated such that the support 35 is adjacent the support 10'. A person to be examined then lies or sits in the dentists chair with their head on the head rest. The slide 36, and hence support 35, is then slid along the frame member 40 to a suitable position and is locked in place. The L-shaped frame 30 is then rotated about the axis y_4 to a position such as that shown in Figure 4 and 5, where the support 35 is above the neck or upper chest of the patient. If necessary, the screw 37 can be screwed inwardly, to raise the support 35 further above the patient. The support 10' is then raised such that the head of the patient is located between the two ends of the support 10', where it is locked in place. Once the examination or operation has been completed, the dentist reverses the steps to allow the patient to alight from the chair.

The dentist may then use the support 10' and cross piece 35 as supports for his forearms whilst examining or operating on the patient. The support 10' may be higher than the support 35. The support 10' may be connected to the spigot 20a by a

lockable universal joint which allows the support to be tilted or pivoted. The support 35 need not be straight, as shown, it may be of curvilinear form, semi-circular, elliptical or so on. One or other of the support surfaces 10' 35 may be absent.

Figure 6 shows a chair 50 having a seat 52 with a backrest 53 located on a bracket 53a and set of casters 54. The chair 50 is provided with a support surface 60, mounted thereto on a frame member 61 telescopically mounted in a support 61a which is mounted to the underside of the chair using mounting bracket 61b. The support surface 60 is an elongate cranked member having a shorter limb 62 and a longer limb 63 and is attached to the telescopic frame member 61 at the join between the two limbs 62, 63 and is rotatable about the axis 64 of the frame member 61.

The height of the support surface 60 above the seat 52 is adjustable using a gas lift to telescope the member 61, as is known. The support surface 60 may be pivoted about axis 64 and then locked into position.

A support surface 60 may be mounted to either side of the chair 50.

In use, a person sits in the chair 50, raises the support surface 60 to the desired height and rotates the support surface 60 to the desired position, where it is locked in place.

Figure 6 shows the 'safe' position allowing a person to sit in or get up from the seat 52. When the longer limb 63 extends out of the 'footprint' of the seat 52, the shorter limb 62 will extend over the lap of the sitter (because of the crank), thereby

preventing the sitter from getting up from the seat 52. Thus, it is necessary to stow the support surface 61 in the safe position before getting up from the chair.

If two support surfaces 61 are provided they will be positionable at different heights with respect to the seat 52, and at different angles to one another. The support surface 61 may be joined to the telescopic support 61 using a swivellable connector so that the support surface 61 need not be horizontal.

Figures 7, 8a and 8b show a chair 50' (similar parts being identified by identical numerals identified with a prime (')) where the support surface 60' is mounted on a universal joint 70, to allow the support surface 60' to be stowed in a 'safe' vertically aligned position. The support surface 60' is movable in the direction of arrow L because frame member 61' is telescopic or at least has one part which moves vertically relative to another. The support surface 60' will be positionable and securable in any aspect.

The embodiments of Figures 6, 7, 8a and 8b may be used by dentists (usually using a pair of supports 60, 60') sonographers (usually using a single support 60, 60'), surgeons, keyboard operators and the like.

Each support 10, 10' 10", 10a", 35, 60, 60' may be padded and/or covered in a plastics material, preferably a hygienic cleanable plastics material.

When used in a surgical or dental setting, the support surfaces 10, 10' 10", 10a", 35, 60, 60' may incorporate clamps or other attachment accessories for the attachment of trays, bins and containers. The support surface 10, 10' 10", 10a", 35,

60, 60' may incorporate a magnet or have a partially or completely magnetised surface for holding various tools while the operator is undertaking different procedures. In such an embodiment a metal tray maybe used to hold the operators tools. The metal tray would provide a more substantial surface for tools, the magnet retaining both the tray and the tools. Also, at the end of the procedure the tray with tools loaded thereon may be picked up and placed in an autoclave for decontamination.

It will be appreciated that each support 10, 10' 10", 10a", 35, 60, 60' may be mounted to allow for the desired degree of movement, pivotal, rotational, and so on. It will be further appreciated that using the apparatus of the current invention the loads placed on users shoulders and backs will be greatly reduced whilst also not forcing the user to support the weight of their arms on their wrists.

It will be further appreciated that each support 10, 10' 10", 10a", 35, 60, 60' is continuously positionable in both the horizontal and vertical axis, rather than positionable in a plurality of discrete positions, thus providing the maximum of flexibility for the user. This also ensures that different users can readily alter the positions of the supports 10, 10' 10", 10a", 35, 60, 60' to their own needs.